

WHAT IS CLAIMED IS:

1. A liquid transfer device transferring liquid for enhancing durability of an image on a printed surface of  
5 a printed product printed with ink, comprising:

a liquid transfer member having a transfer surface contacting the printed surface of said printed product and transferring the liquid on the printed surface of said printed product,

10 said liquid transfer member including  
a liquid accumulating portion accumulating the liquid; and  
a restricting portion supplying the liquid in  
said liquid accumulating portion to said transfer  
15 surface with restriction.

2. The liquid transfer device as claimed in claim 1, wherein said restricting portion is formed from a porous film formed with fine pores.

20 3. The liquid transfer device as claimed in claim 2, which further comprises a holding member for receiving and holding said liquid transfer member.

25 4. The liquid transfer device as claimed in claim 1, wherein said liquid accumulating portion is formed from a sheet form member having uniform density.

5. The liquid transfer device as claimed in claim 3, wherein said holding member includes a surface supporting frame formed with an opening portion exposing said  
5 restricting portion and a dish shaped receptacle member having a flange mating with a lower surface of said surface supporting frame, said liquid transfer member is received within a receptacle space defined by said receptacle member and said surface supporting frame.

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6. The liquid transfer device as claimed in claim 1, wherein said liquid accumulating portion is formed from a sheet form member having different density in thickness direction thereof.

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7. The liquid transfer device as claimed in claim 6, wherein said liquid accumulating portion is formed from a sheet form member provided with treatment for continuously varying a density in thickness direction with a  
20 predetermined gradient.

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8. The liquid transfer device as claimed in claim 6, wherein said liquid accumulating portion is formed by laminating a plurality of sheet form members having different densities.

9. The liquid transfer device as claimed in claim 2,

wherein capillary forces of said liquid accumulating portion, said porous film and the printed surface of said printed product are set for establishing a relationship:

5 liquid accumulating portion < porous film < printed surface of printed product.

10. The liquid transfer device as claimed in claim 8,  
wherein densities of respective sheet form members forming  
10 said liquid accumulating portion are set for producing  
greater capillary force at closer position to said transfer  
surface.

11. The liquid transfer device as claimed in claim 7,  
15 wherein said liquid accumulating portion is formed with  
a first layer and a second layer having different densities,  
said first layer is located at a position more distant from  
said transfer surface than said second layer, and said first  
layer has greater density than said second layer.

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12. The liquid transfer device as claimed in claim 11,  
which further comprises a holding member receiving said  
liquid transfer member, said holding member includes a  
surface supporting frame having an opening portion, into  
25 which said first layer covered with said restricting portion  
is inserted, and a dish shaped receptacle member having  
a flange mating with a lower surface of said surface

supporting frame,

said second layer is received with a receptacle space defined by said receptacle member and said surface supporting frame and said first layer covered by said 5 restricting portion projects upwardly from a surface of said surface supporting frame, and a surface of said restricting portion forms a transfer zone.

13. The liquid transfer device as claimed in claim 11, 10 wherein said first layer and said second layer are formed from a fibrous body or a foamed sponge body, a density of said first layer is in a range of 0.05 to 0.5 g/cc, and a density of said second layer is in a range of 0.01 to 0.2 g/cc.

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14. The liquid transfer device as claimed in claim 2, wherein said porous film has a thickness of 10 to 200  $\mu\text{m}$ , and a diameter of fine pore is 0.1 to 3  $\mu\text{m}$ .

20 15. The liquid transfer device as claimed in claim 1, wherein said liquid transfer member has a normally flat transfer surface, when the printed product is mounted and urged onto said transfer surface, said liquid accumulating portion is elastically deformed corresponding to a curved 25 shape of the printed surface of said printed product so that said curved printed surface and said transfer surface are contacted over entire area.

16. The liquid transfer device as claimed in claim 15,  
wherein stripe form grooves are formed on a bottom surface  
of said liquid accumulating portion.

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17. A liquid holding device holding a liquid by capillary  
force, comprising:

a plurality of divided liquid holding members, each  
holding the liquid by capillary force thereof,

10 wherein each of the plurality of divided liquid  
holding members are determined in capillary force and size  
so that a total liquid amount to be held by said divided  
liquid holding members is greater than a liquid amount to  
be held by a liquid holding member before division,  
15 irrespective of attitude of said liquid holding device.

18. The liquid holding device as claimed in claim 17,  
wherein each of the plurality of liquid holding members  
is determined in size so as to hold the liquid over  
20 substantially entire region of said liquid holding member  
irrespective of attitude of said liquid holding device.

19. A liquid transfer device transferring liquid to an  
object to be transferred the liquid, comprising:

25 a transfer film permeating said liquid and contacting  
said object to be transferred the liquid for transferring  
the permeating liquid; and

an accumulating portion including a plurality of divided accumulating members accumulating the liquid to be supplied to said transfer film and permeating therethrough, by capillary forces thereof, each of said 5 plurality of accumulating members having such capillary forces and sizes that a total liquid amount to be held by said divided liquid holding members is greater than a liquid amount to be held by a liquid holding member before division, irrespective of attitude of said liquid holding device.

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20. The liquid transfer device as claimed in claim 19, wherein each of said plurality of liquid accumulating members is set at a size for accumulating the liquid over substantially entire region of said liquid accumulating member 15 irrespective of attitude of said liquid transfer device.

21. The liquid transfer device as claimed in claim 19, wherein said plurality of liquid accumulating members are 20 dividedly arranged so that liquids accumulated in each of said plurality of liquid accumulating members are communicated with each other as depressed through said transfer film.

25 22. The liquid transfer device as claimed in claim 19, wherein said plurality of liquid accumulating members are separated from each other by partitioning walls.

23. The liquid transfer device as claimed in claim 22, wherein thicknesses of said partitioning walls are in a range of 0.1 mm to 1 mm.

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24. The liquid transfer device as claimed in claim 23, wherein said plurality of liquid accumulating members are processed at an accuracy so that a length of burr possibly formed during processing becomes less than the thickness 10 of said partitioning wall.

25. A liquid transfer device transferring a predetermined liquid to an object to be transferred the liquid, comprising:

15        a porous body having a transfer zone to be contacted with said object to be transferred the liquid;  
            an absorbing body arranged in contact with said porous body and capable of absorbing and holding the liquid; and  
            a colored member embedded in said absorbing body and  
20     being visible through said absorbing body.

            wherein a liquid remaining amount in said absorbing body can be monitored on the basis of view condition of said colored member variable depending upon transmission coefficient of said absorbing body variable according to  
25     increase number of times of transfer of said liquid.

26. The liquid transfer device as claimed in claim 25,

wherein said absorbing body is supported by an essentially transparent receptacle member, and said colored member is visible through said receptacle member and said absorbing body.

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27. The liquid transfer device as claimed in claim 25, wherein said absorbing body includes a first absorbing body having a first density and a second absorbing body having a second density lower than said first density, and said 10 colored member is visible through said second absorbing body.

28. The liquid transfer device as claimed in claim 25, wherein an embedding height of said colored member in said 15 absorbing body is determined so as to detect lacking of liquid remaining amount in said absorbing body from view condition of said colored member at a timing where a predetermined times of liquid transfer is completed.

20 29. The liquid transfer device as claimed in claim 28, wherein said absorbing body includes a first absorbing body and a second absorbing body, and thickness of at least one of said first absorbing body and said second absorbing body is determined so as to detect lacking of remaining liquid 25 amount in said absorbing body from view condition of said colored member at a timing where a predetermined times of liquid transfer is completed.

30. The liquid transfer device as claimed in claim 25,  
wherein said colored member has a plurality of holes  
permitting flow of said liquid.

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31. The liquid transfer device as claimed in claim 25,  
wherein said colored member has an external dimension of  
at least 5 mm square.

10 32. The liquid transfer device as claimed in claim 25,  
wherein said colored member is embedded in said absorbing  
body at a position not overlapping with said transfer zone.

15 33. The liquid transfer device as claimed in claim 25,  
wherein said colored member is embedded in said absorbing  
body at a position overlapping with said transfer zone.

20 34. The liquid transfer device as claimed in claim 25,  
wherein said colored member is embedded in said absorbing  
body in a tilted state relative to the surface of said porous  
body so that lacking of liquid remaining amount in said  
absorbing body can be perceived from view condition of said  
colored member at a time of completion of transfer for a  
predetermined number of times.

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35. The liquid transfer device as claimed in claim 34,  
wherein said colored member can be seen through said porous

body and said absorbing body.

36. The liquid transfer device as claimed in claim 34, wherein said absorbing body includes a first absorbing body having a first density and a second absorbing body having a second density lower than said first density, thickness of at least one of said first absorbing body and said second absorbing body is determined so that lacking of liquid remaining amount in said absorbing body can be perceived from viewing condition of said colored member at a time of completion of transfer for a predetermined number of times.

37. The liquid transfer device as claimed in claim 34, wherein said colored member has a plurality of holes permitting flow of said liquid.

38. A liquid remaining amount monitoring method of a liquid transfer device having a porous body having a transfer zone contacting an object to be transferred liquid and an absorbing body arranged in contact with said porous body and capable of absorbing and holding a predetermined liquid, and transferring said liquid to said object arranged in said transfer zone, wherein said method comprising the steps of:

embedding a colored member in said absorbing body to be viewed through said absorbing body, and

monitoring a liquid remaining amount in said absorbing body on the basis of view condition of said colored member depending upon a transmission coefficient of said absorbing body variable according to increase of number of times of  
5 transfer of said liquid.

39. The liquid remaining amount monitoring method as claimed in claim 38, wherein said colored member is embedded in said absorbing body in a tilted state relative to the  
10 surface of said porous body.

40. A liquid transfer device transferring liquid for enhancing durability of an image for a printed surface of a printed product printed with ink, comprising:

15 a liquid transfer member transferring said liquid to the printed surface of a printing medium by contacting the printed surface of said printing medium on a transfer surface externally exposed,

20 said liquid transfer member having a liquid accumulating member accumulating the liquid by capillary force and having a primary surface positioning said transfer surface at an upper portion, said liquid accumulating member having a dimension greater than a dimension where an initial accumulation amount corresponding to a predetermined  
25 number of times to transfer the liquid becomes a maximum absorbing capacity.

41. The liquid transfer device as claimed in claim 40,  
wherein said liquid accumulating member is determined a  
dimension so that an amount of the liquid to be held without  
causing leakage even upon exposing to atmosphere becomes  
5 said initial accumulation amount.

42. The liquid transfer device as claimed in claim 40,  
wherein said liquid accumulating member is determined a  
dimension so that an amount of the liquid to be held without  
10 causing leakage even when the primary surface is oriented  
in vertical direction, becomes said initial accumulation  
amount.

43. The liquid transfer device as claimed in claim 40,  
15 wherein said liquid accumulating member is determined a  
dimension in a direction of said primary surface so that  
said primary surface becomes larger than said transfer  
surface.

20 44. The liquid transfer device as claimed in claim 41,  
wherein said liquid accumulating member has a layer having  
relatively high density and in which said transfer surface  
is positioned, and a layer having relatively low density  
and in which said primary surface is arranged, said liquid  
25 accumulating member is determined a dimension so that a  
sum of the amounts of liquid to be held without causing  
leakage in each of said layers becomes said initial

accumulation amount.

45. The liquid transfer device as claimed in claim 42, wherein said liquid accumulating member has a layer having relatively high density and in which said transfer surface is positioned, and a layer having relatively low density and in which said primary surface is arranged, said liquid accumulating member is determined a dimension so that a sum of the amounts of liquid to be held without causing leakage in each of said layers becomes said initial accumulation amount.

46. The liquid transfer device as claimed in claim 40, wherein a dimension of said layer having relatively low density in a direction of said primary surface is determined so that said primary surface of said layer having relatively low density is larger than a bottom surface of said layer having relatively high density where said transfer surface is positioned and mating with said primary surface.

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47. The liquid transfer device as claimed in claim 40, wherein a porous film formed with fine pores restrictingly supplying the liquid exuding from said liquid accumulating member, is arranged on said transfer surface.

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48. The liquid transfer device as claimed in claim 47, wherein said initial accumulation amount is determined with

taking an amount of liquid to be held by said porous film without causing leakage, and the dimension of said liquid accumulating member is determined corresponding to said initial accumulation amount.

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49. The liquid transfer device as claimed in claim 40, wherein grooves for smoothly moving said liquid to the position corresponding to said transfer surface are provided in said liquid accumulating member.

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50. A liquid transfer method for transferring liquid enhancing durability of an image to a printed surface of a printed product printed with ink, comprising the steps of:

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providing a liquid accumulating portion accumulating the liquid and a restricting portion restrictingly supplying the liquid in said liquid accumulating portion to a transfer surface contacting the printed surface of said printed product, and

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transferring the liquid supplied through said restricting portion by mounting the printed surface of said printed product on said transfer surface in contact therewith.

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51. The liquid transfer method as claimed in claim 50, wherein said printed surface of said printed product has an area greater than said transfer surface, and said printed

surface is contacted with said transfer surface dividedly for a plurality of times.

52. A liquid transfer method transferring a liquid to  
5 an object to be transferred the liquid, comprising the steps  
of:

providing a liquid transfer device having a transfer film permeating said liquid and transferring the permeated liquid in contacting with said object, and an accumulating  
10 portion accumulating the liquid to be supplied to said transfer film and permeated therethrough and having a plurality of divided accumulating members, each of said accumulating members being determined a capillary force and a size so that a total liquid amount accumulated in  
15 said plurality of divided accumulating members becomes greater than a liquid amount to be accumulated in the accumulated portion before division irrespective of attitude of said liquid transfer device; and

in transferring the liquid to said object,  
20 communicating liquids accumulated in each of said plurality of accumulating members with each other by depressing said plurality of accumulating members through said transfer film by urging said object onto said transfer film.

- 25 53. The liquid transfer method as claimed in claim 52, wherein each of said plurality of liquid accumulating members is determined in size so as to accumulate over

substantially entire region of said liquid accumulating member irrespective of the attitude of said liquid transfer device.

5 54. A liquid transfer method for transferring liquid for enhancing durability of an image for a printed surface of a printed product printed with ink, comprising:

providing a liquid transfer device defined in any one of claims 40 to 49;

10 mounting said printed product in a condition where said transfer surface mates with said printed surface; and

performing said transfer by applying said liquid to said printed surface via said transfer surface from said liquid accumulating member.